California site heavily involved in Sandia's mission areas

Div. 8000 VP Marianne Walck on challenges, opportunities facing the site

Sandia Lab News *California team members Patti Koning and Michael Padilla (both 8521) sat down recently with new California Laboratory Div. 8000 VP Marianne Walck. She talked about her relocation to California, potential recruitment and retention issues the site faces, momentum of the Livermore Valley Open Campus (LVOC), challenges and opportunities facing the Energy and Climate Program Management Unit, and her lifelong love of the violin. Prior to moving to California, Marianne was the director of Geoscience, Climate, and Consequence Effects Center 6900 at Sandia/New Mexico.*

***Lab News:** How did you feel about moving to California?*

Marianne Walck: I lived in California before, but it was Southern California, so the Bay Area is a new experience for me. I was a graduate student at the California Institute of Technology in Pasadena from 1978 to 1983. Gov. Jerry Brown was also in office back then, so he is a familiar face. I enjoy the weather and being near the ocean, but I am still getting used to the crowds and traffic.

***LN:** What do you miss most about New Mexico?*

MW: The green chile and New Mexico food in general. And, of course, I miss my friends and colleagues in Albuquerque.

***LN:** What do you find exciting about the California site?*

> *"We are starting new construction in the Livermore Valley Open Campus. In June, we broke ground on Bldg. 926, which should be completed by the end of next year. As this new space becomes available, we will be removing the old trailers in the Redwood Center."*

MW: I really enjoy the smaller size, friendly people, and variety of work at the California site. The mix of mission work in the division is invigorating and I am still working to learn about the breadth of our technical contributions. The intimacy of the site and activities like the Farmers' Market and fun runs have helped build a sense of community.

I'm also excited about the site development plan. We are starting new construction in the Livermore Valley Open Campus. In June, we broke ground on Bldg. 926, which should be completed by the end of next year. As this new space becomes available, we will be removing the old trailers in the Redwood Center.

(Continued on page 5)

Livermore, California
Sandia LabNews

Volume 67, No. 16
August 21, 2015

Managed by Sandia Corporation for the National Nuclear Security Administration

SANDIA PRESIDENT AND LABORATORIES DIRECTOR Jill Hruby tells an all-hands audience at Sandia/California that "The lab is in a sweet spot" right now. See **page 3.**

Gone phishing

Think before you click. That is a key message Margot Kimura (8966) wants people to remember before clicking on links, opening attachments, or responding with personally identifiable information (PII) or other sensitive information in email. **See page 6.**

Inside . . .

W80-4 LEP on track

Sandia is doing what it hasn't done in decades: extending the life of a nuclear warhead at the same time the US Air Force develops a replacement cruise missile that will carry the weapon. And Sandia/California has a major role. **See page 7.**

Algae nutrient recycling a triple win

Sandia method cheaper, greener, cuts competition for fertilizer

By Patti Koning

Nitrogen and phosphate nutrients are among the biggest costs in cultivating algae for biofuels. Sandia molecular biologists Todd Lane (8633) and Ryan Davis (8624) have shown they can recycle about two-thirds of those critical nutrients, and aim to raise the recycling rate to close to 100 percent.

Recycling nitrogen and phosphate has benefits that go far beyond cost. While nitrogen can be produced through a

(Continued on page 8)

RYAN DAVIS and Sandia colleagues have developed a method to recycle critical and costly algae cultivation nutrients phosphate and nitrogen. (Photo by Dino Vournas)

Sandia's telemetry work ramps up as weapons program intensifies

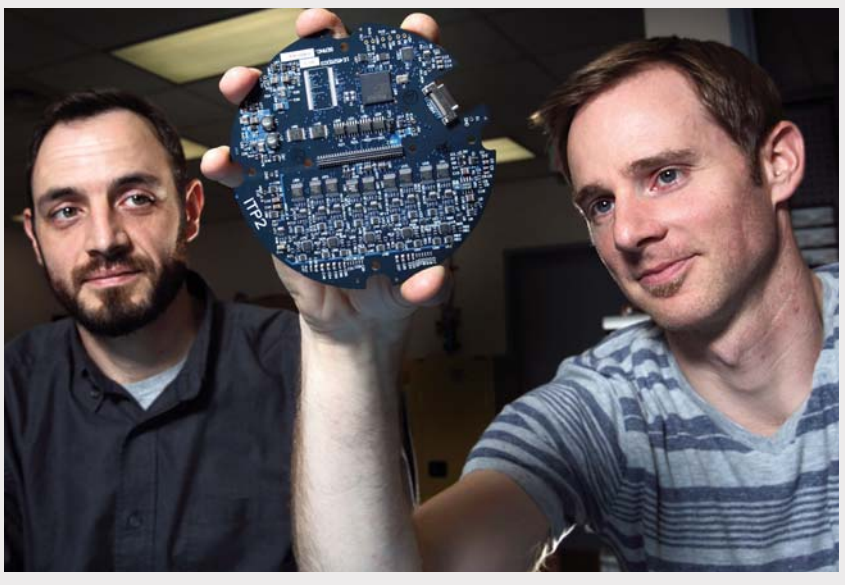
Developing data instrumentation systems to support NNSA, DoD programs

By Michael Padilla

As Sandia's nuclear weapons program continues to execute three full-scale engineering development programs to help extend the life of the stockpile, Sandia's Telemetry Systems departments have seen a dramatic increase in their work in designing, building, and testing high-performance instrumentation systems for ground and flight tests.

These organizations are responsible for developing data instrumentation systems to support various nuclear weapons programs for the DoD and NNSA.

The systems created at Sandia/California are used by weapon development and stockpile evaluation programs to collect weapon performance data, which is used in qualification activities and annual assessments.



WEAPON PERFORMANCE DATA COLLECTORS — Brett Chavez and Jerrod Peterson (both 8135) build and test high-performance instrumentation systems for ground and flight tests. (Photo by Dino Vournas)

The next generation of telemetry systems

Since the early 1980s, Sandia/California has helped lead the telemetry systems work for the Joint Test

(Continued on page 4)

Diversity and Inclusion: What's in it for me? – One white male's perspective

By Bert Debusschere

A few months ago, a visitor in our group who wanted to inject humor into the topic of computer model selection showed a slide with swimsuit models in a beauty pageant. Fortunately, no women were present. However, such messages contribute to an environment where women do not feel valued for their professional contributions. Indeed, the scientific community has a ways to go yet when it comes to diversity (which I think of as the collection of all of our differences) and inclusion (valuing people for what makes them unique).

BERT DEBUSSCHERE, a mechanical engineer working in applied math research. He works to develop algorithms and tools for uncertainty quantification in computational simulations and to apply these methods to climate modeling, resilient extreme scale computing, and shock hydrodynamics.

Truth is, a few years ago, I probably would have failed to pick up on this not-so-subtle message and would have chuckled along with everyone else in the room. Growing up in Belgium, in a very homogeneous society, I did not interact with many minorities. Further, being in a boys-only school from elementary level through high school and then going on to study in the male-dominated field of engineering did not help my comfort level around women, let alone my ability to relate to their perspectives. As such, for most of my life, I have been pretty disconnected from minorities and women.

On the surface, this did not seem to affect my technical career at Sandia too much. Being in a white- and male-dominated workforce, my unease around women and minorities was not openly a roadblock. Did I ever knowingly discriminate against or talk ill of women and minorities? Not that I am aware of. However, my disconnect with women and minorities left my implicit biases unchecked, which probably clouded my impressions of interview candidates, research collaborators, and others.

Over the past few years, however, I have participated in some in-depth personal development and diversity training opportunities at Sandia. Through many uncomfortable, but very enriching, conversations, I started seeing and facing my biases and fears. In the past, I was hesitant to discuss issues such as racism or sexism, for fear of exposing my ignorance or offending someone. By developing trusting relationships, we can have these conversations openly and grow in the process. Working through all of this with a diverse group of people built an enormous amount of interpersonal trust, which enabled me to develop some very deep connections with women and minorities.

I tend to work in teams that are much more diverse now. This does lead to uncomfortable situations occasionally, such as the time we worked with a group that kept using the term "master/slave model" for computer task management. Awkward? Yes! But as a group, we talk about, rather than try to ignore, these incidents. More importantly, the input and technical expertise from the people I was previously uncomfortable working with are phenomenal. And the work we deliver is much more bold and innovative.

So what happened with the swimsuit model incident? I had a friendly conversation with the visitor about why I felt the slide was offensive to women. He appreciated the conversation, and we're still on good terms with each other.

Besides these obvious benefits to my work at Sandia, I have found that by being able to develop stronger connections with minorities and underrepresented groups, all of my other relationships have also improved substantially. Diversity and inclusion is not just about how we treat minorities and underrepresented groups, it's about how we treat everyone. A friend of mine recently commented that I tend to smile more and seem happier. He is right. I am happier with my work and my life in general.

What promise does a more diverse and inclusive environment hold for you?

California intern symposium particpation sets new record

ELIZABETH ALLENDORF (8956) was one of more than 50 interns at the California site who presented their summer research through posters and presentations at the annual Intern Symposium on July 29. This summer the site hosted a record 128 summer interns. (Photo by Dino Vournas)

Retiree deaths

Robert Hole (age 83) . . . . . June 7
C. Davidson (88) . . . . . June 7
Richard Feil (85) . . . . . June 8
Edward Baynes (69) . . . . . June 9
Shawkeet Hindi (78) . . . . . June 11
Tomas Apodaca (88) . . . . . June 11
Theresa Wise (66) . . . . . June 12
Fred Jones (77) . . . . . June 14
Pete Morris (93) . . . . . June 14
Adenago Perea (94) . . . . . June 19
Bobby Allen (80) . . . . . June 20
Lillian Bennett (88) . . . . . June 21
Herbert Frahm (86) . . . . . June 21
Mary Coffey (92) . . . . . June 23
Carl Schuster (80) . . . . . June 23
George Williamson (77) . . . . . June 29
Pablo Garcia (92) . . . . . July 3
Glenn Burger (94) . . . . . July 5
Gina Lamons (58) . . . . . July 5
James Fisher (87) . . . . . July 10
George Revels (88) . . . . . July 12
Marion Scott (85) . . . . . July 12
Robert Donohoe (88) . . . . . July 12
Don O'Dell (86) . . . . . July 12
T. Tucker (86) . . . . . July 17
Ira White (87) . . . . . July 17
Kenneth Byrne (80) . . . . . July 20
Homer Pierce (91) . . . . . July 20
Judith Hawbaker (76) . . . . . July 20
Deborah Jean Cazzola (62) . . . . . July 31

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Livermore, California 94550-0969
Tonopah, Nevada • Nevada National Security Site
Amarillo, Texas • Carlsbad, New Mexico • Washington, D.C.

Sandia National Laboratories is a multiprogram laboratory operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corp., for the US Department of Energy's National Nuclear Security Administration.

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Lab News fax 505-844-0645
Classified ads 505-844-4902

Published on alternate Fridays by Internal & Digital Communications Dept. 3651, MS 1468

LOCKHEED MARTIN

9th annual California edition

PATTI KONING AND MICHAEL PADILLA (both 8521) have taken the Sandia *Lab News* editor's seat as guest editors for the 9th annual California issue, which highlights the site's research, people, and happenings.

For the issue, Patti and Michael sought out ideas from directors, managers, researchers, and others from throughout the site to develop stories that showcase each center and the variety of work at the California site.

Patti covers homeland security, biology, material science, and hydrogen and she also provides communication support to site leadership. Michael covers cybersecurity, nuclear weapons, and the Combustion Research Facility. (Photo by Dino Vournas)

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Jill Hruby makes first visit to Sandia/California as Labs leader

'Lab is incredibly healthy,' new Sandia president and Labs director reports at all-hands meeting

MISSION DRIVEN—Jill Hruby returns to Sandia/California to talk to employees about the state of the Labs. Jill, who began her Sandia career in California in 1983, praised the Labs' commitment to delivering its nuclear weapon work on time, on schedule, and on cost. (Photo by Randy Wong)

By Michael Padilla

"It's great to be back in California," Jill Hruby told a standing-room-only crowd in the Combustion Research Facility auditorium during an all-hands meeting as part of her first official visit to Sandia/California as Sandia's president and Laboratories director.

"The Lab is incredibly healthy," Jill said. "We are in a really sweet spot right now in the Laboratories' history — I've worked here a long time — we occasionally get sweet spots, and we are in one of them. The reason why we are in a sweet spot is because we have a very active, very challenging nuclear weapons program."

Jill highlighted the progress Sandia has made in strengthening its nuclear weapons program and discussed the efforts to ensure that the work is delivered on time, on schedule, and on cost. She mentioned the continued work on the B61 Life Extension Program and the work on the W80-4 executed in California. She also highlighted the recent, successful B61-12 Life Extension Program development flight test at Tonopah Test Range conducted this summer. The flight test consisted of hardware designed by Sandia.

"Our reputation is really high right now as a result of that," she said. "We need to be careful not to be oversold. There is a lot to do in New Mexico and in California, and we are doing it. I have great confidence that we will continue to deliver on all weapons programs."

When the nuclear weapons program is healthy, Jill said, the Laboratory is in great shape. She also emphasized the work Sandia does in cyber, space, advanced conventional weapons, intelligence work, energy, and bio.

"We have a lot of opportunities when the world is a complicated place, and right now the world is a complicated place," she said.

Jill noted that Sandia's mission support activities are vital to the Laboratories' well-being and emphasized that she wants to focus on mission work. She said Sandia's new strategic plan — which will be released soon — will address the mission areas.

She also mentioned the importance of safety and security at Sandia.

During the next couple of months, she said, the Laboratories will be engaged in the annual assessment of the US nuclear weapons stockpile, which will be submitted to the secretaries of Energy and Defense and the chairman of the Nuclear Weapons Council at the end of the fiscal year.

Regarding the contract rebid for Sandia that ends April 30, 2017, Jill said she has a very simple message. "It's all about the people," she said. "I've asked to please don't mess with what matters to our workforce." She said she wants to make sure that Sandia can continue to deliver its mission and keep a healthy benefits program to encourage staff retention.

Questions concerning recruiting, retention, and pay differential for living in California were asked. She said that all these topics are being researched and that Sandia is doing its best to address those issues.

Other questions and comments focused on ways to streamline processes and procedures at Sandia. Jill said that, as long as the Labs continues to meet the mission, she welcomes all suggestions.

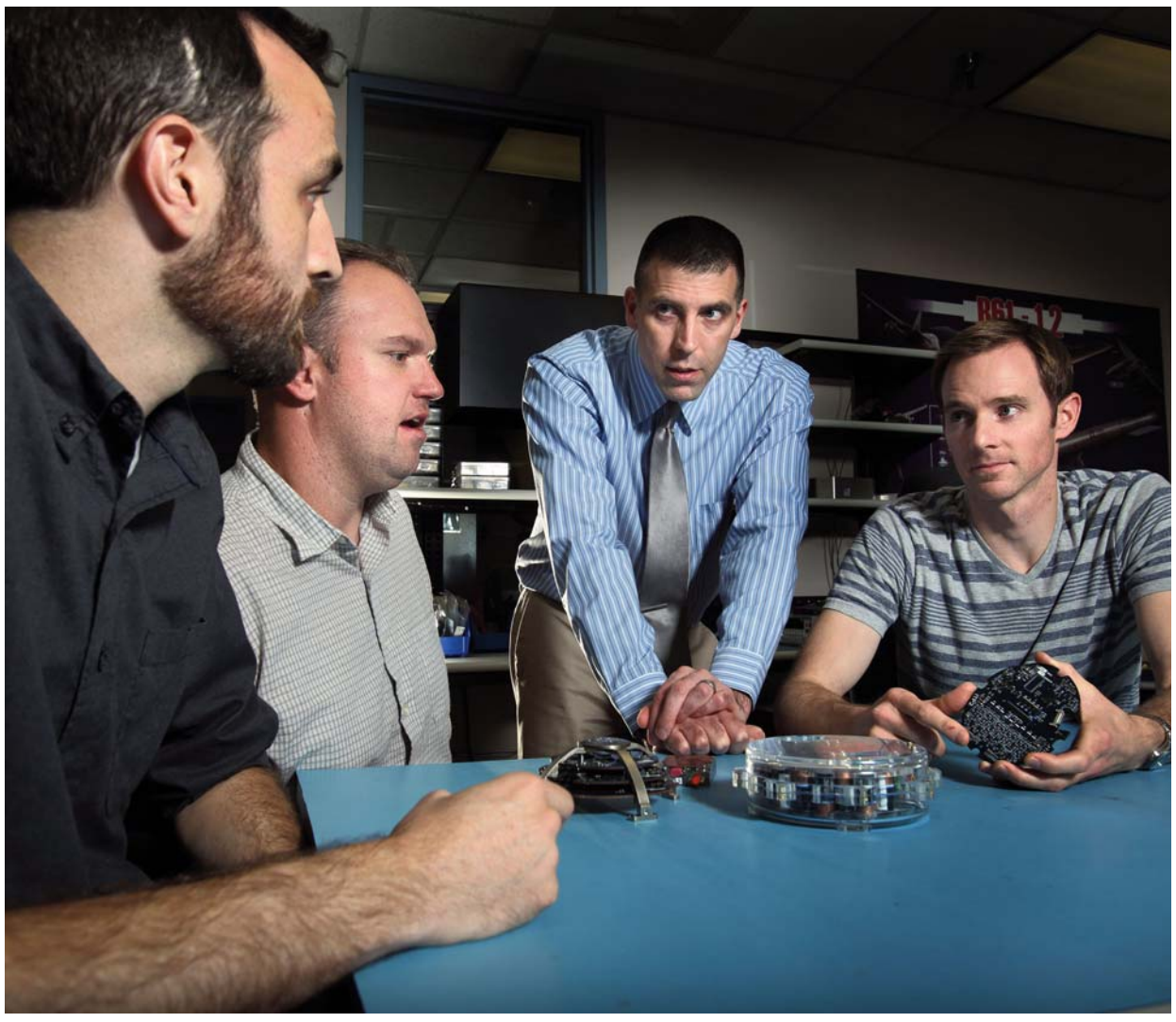
She said she will continue to focus on listening to employees' thoughts and "slowing down the train to ensure that the train remains on track."

BACK IN CALIFORNIA — Jill Hruby visits with members of the Sandia/California workforce during her recent trip to the site. (Photo by Randy Wong)

Sandia's telemetry work kicks into high gear

"We have a bright future. We get to design, build, test, and deliver lots of hardware, which not everyone here onsite gets to do and we learn from each iteration. It's an exciting and challenging environment for our engineers."

— Jennifer Clark (8135)



TELEMETRY TALK—Brett Chavez (8135), Chris Kershaw (8135), Bruce Brunett (8135), and Jerrod Peterson (8135) discuss various instrumentation systems used in weapon development and stockpile evaluation programs. (Photo by Dino Vournas)

"Our work touches so many organizations including, design engineering, shipping and receiving, test facilities, epoxy lab, and materials lab. All those people have done a wonderful job in supporting the telemetry systems groups in meeting their mission."

— Kathryn Hughes (8133)

(Continued from page 1)

Assembly (JTA) program for the nuclear security enterprise. Currently, the California groups are working on several new telemetry systems to support the W88 ALT 370, B61-12, W80-4, and Mk21 fuze program.

In addition to the high number of simultaneous development programs being supported, the amount of hardware being requested by these programs is at an all-time high. The telemetry groups do a large majority of this hardware development before transitioning it to the National Security Campus in Kansas City, Missouri. In today's environment of high-rigor qualification activities, the amount of hardware needed over the life of the program development to support their system-level test units has increased from a few handfuls in the past to today's steady stream of test units for the W88 ALT370 and B61-12.

Fully prototyped and proven operational

These newest telemetry (TM) designs also include new features. For example, earlier this year, the B61-12 telemetry team added a data recording capability to its instrumentation system design. The team's goal was to ensure all contact fuzing end-event data will be captured during surveillance flight tests.

"This recorder — christened the HDR (hardened data recorder) — must be capable of recording all critical weapon-scoring data in milliseconds while surviving free-fall ground impacts," says Ryan Layton (8133). "A team of engineers from 8133 took on the challenge of building a smaller version of the HDR, leveraging the experience they gained building the B61 JTA modernization flight recorder."

"The HDR is a small part of the B61-12 JTA telemetry system that plays a big role," says Tim Kostka (8133). "Its job is to record and store data critical to assessing the reliability of the weapon."

This is achieved by containing the electronics in a stainless steel housing and encapsulating them using dense, rigid foam. As part of the design process, the HDR will go through rigorous testing, including shock testing, before it is delivered and flown in the system.

The HDR has already been fully prototyped and proven operational during benchtop testing. From mid-August through September the product will undergo physical and thermal testing for performance at high temperatures, extreme cold temperatures, and a range of other environmental and mechanical conditions.

Development of new capabilities and technologies

Another challenge for these groups is finding ways to provide more and more data while still living within system-level design constraints.

The W88 ALT370 team recently successfully delivered units for an Environmental Development JTA (EDJTA). The purpose of the EDJTA flight bodies was to gather data as seen by the weapon throughout a typical flight profile. This information will be used to help create and validate environmental requirements for Weapon Reserve components. These units captured multiple channels of data from sensors located throughout the flight test body.

To be able to monitor the multiple channels of data at the requested sampling rate and transmission bandwidth needed by the W88 systems organization, the TM engineers needed to come up with a more efficient way of collecting and transmitting data.

They did this with two new design features. One was the implementation of a new compression algorithm, which allowed three times as many sensors to be monitored as would have been possible without compression.

"The algorithm allows transmission of the same or similar information in fewer numbers of bits," says Bruce Brunett (8943). "In telemetry systems the goal is to balance between the amount of information conveyed and the bandwidth used in the transmission."

There is a constant push to get more data from the units. But the limiting factor is the receiving assets on the ground that constrain the amount of information that is sent. The main objective was figuring out a way to get more information with fewer bits.

"The system was pretty challenging to implement," says Jerrod Peterson (8135). "The work was driven by a real application, customer request, and also based on goals for the program. The challenge was placed on the team and we made leaps in capabilities."

The compression algorithm is also currently being used by other program telemetry teams as well.

The second enabling feature in the W88 EDJTA bodies was the incorporation of a new transmitter that uses RF bandwidth more efficiently than the pulse code modulation — PCM — used in previous transmitter designs. Use of this modulation method allows a substantially greater percentage of data to be transmitted within the same RF bandwidth allocations.

A new battery pack

The W88 ALT TM also uses a new battery pack designed and developed by Sandia in Albuquerque. The new battery allows the TM to record environmental data prior to launch while the unit is still with the launch vehicle. This is a first for JTAs.

Typically a chemical battery is activated after launch and there is no way to collect in-tube data. Getting enough capacity in a small volume and getting certification for the battery to be flown during the test were two hurdles the group had to overcome. The battery went through extreme testing until approved for usage.

The telemetry groups work closely with organizations throughout the Laboratories and rely on them to meet delivery of the products

"Our work touches so many organizations including design engineering, shipping and receiving, test facilities, epoxy lab, and materials lab," says Kathryn Hughes (8133). "All those people have done a wonderful job in supporting the telemetry systems groups in meeting its mission."

Jennifer Clark (8135) adds, "We would not be able to fulfill our mission without them and because of these interdependencies, our engineers get to learn about the wide variety of capabilities and support that the laboratory has."

The TM groups also interact with every weapon system since every system utilizes a TM system developed by these organizations. This gives these engineers a strong insight into the systems designs. "This makes TM a good stepping-stone for designers wanting to eventually to move into systems work," says Jennifer.

In addition to this internal collaboration, the TM organizations work closely with partners at other DOE sites.

The future

There doesn't appear to be any downturn in work for the telemetry groups any time soon. Within the next few years, as the current programs ramp down the W80-4 will be ramping up and several weapon systems groups are planning JTA refreshes.

In addition to this, the teams would like to invest in some new R&D activities including improved detonation monitoring and various kinds of optical sensing.

"We have a bright future," says Jennifer. "We get to design, build, test, and deliver lots of hardware which not everyone here onsite gets to do and we learn from each iteration. It's an exciting and challenging environment for our engineers."

New opportunities for leadership and visibility in the DOE community

(Coninued from page 1)

***LN:** What new perspective do you bring to Div. 8000 in the VP role?*

MW: My deep background in energy includes experience in nuclear energy, fossil energy, environmental management, nuclear waste disposal, geothermal energy, and other areas that are relevant to Sandia's energy programs. I'm also very familiar with leading diverse organizations that support multiple missions, which I believe is a useful skill for the California site.

***LN:** How does Div. 8000 fit into Sandia's mission area framework?*

MW: Div. 8000 supports and is heavily involved in all four of Sandia's mission areas. We play a vital role in nuclear weapons through the W80-4 Life Extension Program, Joint Test Assembly, and telemetry programs. The hydrogen program is rooted in California because of capabilities that were developed through gas transfer systems research. The California site also performs significant work in international nuclear security, radiation detection, transportation energy, bio energy and bio defense, and cyber.

***LN:** Do you think the California site has a recruitment and retention problem, and if so, how do you plan to address it?*

MW: We have a great base of candidates from which to recruit in the Bay Area. However, retention is more challenging in California than New Mexico because the Bay Area has many more high-tech employers. As a result, our California site workforce experiences greater fluidity.

Cost of living is an issue in California. The Human Resources department is addressing this issue, starting with adjustments to California salaries. Despite our efforts, we may still lose staff to private employers that can offer higher salaries and other benefits that Sandia can't offer, like stock options. We need to plan for movement in our workforce and provide the best possible opportunities and experience so that those who leave are tempted to return and even bring others back with them.

"Div. 8000 supports and is heavily involved in all four of Sandia's mission areas. We play a vital role in nuclear weapons through the W80-4 Life Extension Program, Joint Test Assembly, and telemetry programs. The hydrogen program is rooted in California because of capabilities that were developed through gas transfer systems research. The California site also performs significant work in international nuclear security, radiation detection, transportation energy, bio energy and bio defense, and cyber."

In terms of opportunities, Secretary of Energy Ernest Moniz has been great for the energy side of DOE. He combined the Office of Science and Applied Energy programs under one undersecretary to create a better flow of basic research through application.

In addition, Dr. Moniz created six cross-cutting research programs. Two of these, Grid Modernization and Subsurface Engineering, have been selected as bigger programs for FY16. Sandia has a lead role in both areas, so there will be new opportunities for leadership and visibility in the DOE community.

Dr. Moniz is also tackling nuclear waste management and disposal. Sandia is poised to make a significant impact and play a leadership role in this arena, drawing from our extensive experience in the Waste Isolation Pilot Plant and Yucca Mountain projects.

"Another concept being developed is a Nuclear Energy Safety and Technology program, where LVOC would serve as a door to the world, particularly Asia. This program could also use the California site to reach back to New Mexico. Although much of Sandia's radiation detection work takes place in California, most of our nuclear energy technologies are centered in New Mexico. Other programs, such as biology, are already using LVOC as a way to leverage and connect with New Mexico programs."

***LN:** What are your thoughts about the LVOC and how it benefits Sandia?*

MW: The open campus is developing momentum with Bldg. 926 being constructed, CREATE (a third-party-financed building that will house external-facing departments) moving forward through NNSA, and plans to build a hydrogen refueling station by the end of next year. Through these initial investments, we are creating an interface with the outside world to increase the California site's impact.

Another concept being developed is a Nuclear Energy Safety and Technology program, where LVOC would serve as a door to the world, particularly Asia. This program could also use the California site to reach back to New Mexico. Although much of Sandia's radiation detection work takes place in California, most of our nuclear energy technologies are centered in New Mexico. Other programs, such as biology, are already using LVOC as a way to leverage and connect with New Mexico programs.

***LN:** What challenges and opportunities are facing the Energy and Climate PMU?*

MW: The landscape of energy and climate programs is broad and fascinating with many ups and downs. Right now, we have tremendous opportunities coupled with significant uncertainty. One of Sandia's greatest challenges is staying focused on all fronts in a time of flat budgets; doing so will require careful planning and maneuvering on our part.

***LN:** Do you have any near-term goals for the California site?*

MW: The directors and I are starting a strategic planning activity that will focus on articulating the California site's strategic value to the nation and Sandia as a whole. I'm looking forward to working with the directors to create crisp, compelling ideas that we can communicate as a unified management team.

The good news is that Jill Hruby comes from California, so she already understands the California site's value and importance. However, we can still help by providing her with appropriate messages about the California site to convey to DOE and other sponsors and stakeholders.

***LN:** How did you react to Jill Hruby being named the Labs director?*

MW: I love my new boss. I worked under Jill previously for five years and thoroughly enjoyed it. She's decisive, fair, and smart — what's not to like? Jill is also politically astute, practical, and well-versed in Sandia's strengths and technologies, so she will be a powerful advocate. And, it's wonderful to have a female Labs director.

***LN:** What do you do in your free time?*

MW: I have so many interests that I never seem to have enough time for them.

I enjoy downhill skiing, hiking, swimming, reading, and of course spending time with my husband and two sons. However, my primary hobby is music (see box below). My mother was a professional musician, so my sisters and I began playing piano at a young age. I added violin at the age of nine and have been playing continuously ever since.

In Albuquerque, I played with an orchestra and two string quartets. I haven't had time to develop chamber music contacts in Livermore yet, so I still play with those groups when I am back in Albuquerque. In fact, I have a violin in each city.

Playing the violin is a great stress reducer. I think the endorphin rush is similar to what people experience with exercise. I may start out in a feeling tired and irritable, but after a few hours of making music, I feel so relaxed; it's amazing.

Music an essential part of Marianne Walck's life

In 2009, the *Lab News* ran a feature story about Marianne Walck — not Marianne the geophysicist or Marianne the Sandia center director, but Marianne the musician. In that story, Marianne described music as her "life saver."

"As big a load as I carried, I always made time for the music I love," she said.

Here's another excerpt from that story:

Marianne says that when she was growing up one of the things she liked best about playing the violin was playing duets with her grandpa Carl. He was a chemist for many years, but always kept up with his violin.

"He had a great sense of humor," says Marianne. "One of the odd things about the family is that Grandpa was about 5 feet 6 inches while my mom was taller. My sisters and I were even taller, about 5 feet 11 inches. We towered over him. My first violin was a gift from him."

MARIANNE practices violin in 1976. Her mother is at the piano and her grandfather looks on.

Gone phishing: LDRD project takes deep dive into exploring the user's side

By Michael Padilla

Think before you click.

That is a key message Margot Kimura (8966) wants people to remember before clicking on links, opening attachments, or responding with PII or other sensitive information in email.

As part of an Early Career Laboratory Directed Research and Development (LDRD) project, Margot set out to understand email phishing and how people interact with their email.

One of the first tasks she did was to determine what phishing truly is.

To better define phishing, she looked at more than 100 phish samples, and compared existing definitions against a set of four basic examples. She found that most definitions failed to capture the essence of the examples.

"I ran into a lot of problems where definitions were either over-specialized, or based on unsound assumptions," Margot says. "I had to put a lot of effort into building a clear vocabulary to work with."

She established that phishing is using electronic communication to covertly manipulate a target into doing something that is counter to the target's interests.

To fight phishing, she wanted to examine it deeply and from a new context.

"In cybersecurity, there's a tendency to view phishing as being solely a technology problem," she says. "It's not. Users are also a part of the system, and in ways that we often don't think about."

Phish versus spam

There is some confusion on the difference between phish and spam, she says. She differentiates the two by looking at the sender's intent.

"People who send spam want you to buy or 'buy into' something. That could be a product or an idea such as campaign ads," she says. "Spam is advertisements. Spam is annoying, but it's not intended to do harm."

In contrast, Margot says, people who send phish generally want to steal your money or information, and intend to do harm.

A quick primer on phish

Classically, phishing emails contain a link to a compromised website, an attachment that is laced with malware, or a request for information in plain text.

"People who send phishing emails usually try to entice you to click before you think about the email too hard," Margot says. "They may say your account is in danger of being closed, or that you've won a prize. They generally pretend to be someone trustworthy. Remember that it's easy to forge the sender's email address, and it's possible to hack the real sender's email account, so you shouldn't trust email."

So, what should users do? "As a cybersecurity expert once told me, there is no 'silver bullet,'" Margot says. "The best thing you can do is to be skeptical. Think about whether the subject of the email is plausible — you're not going to win a sweepstakes that you didn't enter. Think about whether the email looks and feels real — if your bank usually puts your name and last few digits of your account in the email, then if that information is missing or incorrect, the email probably is not from your bank."

Margot says it is good practice to double-check the email's authenticity before clicking. Advice is to call the sender on the phone if a personal contact, or by doing an online search to verify information in the email. Most legitimate companies have policies about what they do and do not do over email. Never give out personal information via email, and always question whether you really need to give someone the information they're requesting.

Cross-disciplinary team

Margot says she wanted to pursue the LDRD project because of her interest in understanding how people use information and how they come to a decision and act on it. With a broad technical background and expertise in computation, dynamical systems, and group decision-making, she had a pretty good idea on how she wanted to attack the problem, but could also see where she'd need help from others to succeed.

"Luckily, many people at Sandia were happy to help. I found a really great team to work with on my LDRD," she says. "I was really impressed by how many people were willing to participate in our study. Management, the Human Studies Board, and Cybersecurity were extremely supportive."

PHISHING WITH A NEW HOOK — Margot Kimura (8966), front, set out to understand email phishing and how people interact with their email. She teamed up via videoconferencing, left to right, with cognitive psychologist Ann Speed (1462), software developers JT McClain and Derek Trumbo (both 1462), and cyber security expert Michael Rosales (9544). (Photo by Dino Vournas)

The team consisted of cognitive psychologist Ann Speed (now 1462), cybersecurity expert Michael Rosales (now 9544), and two software developers, Derek Trumbo and JT McClain (both 1462).

Quantifying user qualities

The team created and applied tools to explore several hypotheses about why users sometimes succumb to phishing attacks. The intent was to explore phishing from the user's standpoint and to look for correlations between the various hypotheses and users' actions in a realistic setting. The hope was that this information would provide new ideas for countering phishing.

The team created a survey that was sent out to users via an app named Phisherman. The survey included tests, such as asking users to identify phishing emails. Results from the several hundred people who responded provided a rich data set offering clues about user responses to phishing.

The team was able to confirm that users who had some understanding of what phishing is and how it works tended to be less likely to fall for phish.

Margot says she and the team have not analyzed all the data, and since the project dealt with sensitive information, the results cannot be discussed freely.

"Our study is one of the few efforts I'm aware of that begins to quantify qualities about users with regards to phishing," she says. "It's too early to make hard claims, but we are gaining some insights."

A new perspective on users and phish

There is a baseline assumption about phish that she would like to see fixed.

"A lot of people assume that anyone who falls for a phish is an idiot," Margot says. "That's not true. Really smart people who know about phish have fallen for at least one, so it's clear that the problem is much more complex than many people think it is."

What looks "suspicious" to one person might look totally normal to another. "I've seen many claims about what makes a phish hard or not, but I haven't seen a definition that really holds up to close scrutiny," she says. "There's still a lot that we don't know."

Her theory is that this attitude issue is one of the drivers behind the popularity of the word "spearphishing." This allows people to admit to falling for a phish without exposing themselves to accusations of incompetence. A spearphish is typically defined as being a phish that is targeted at an individual, with identifiable information about the person such as employment information or other personal data.

"The idea that 'people who fall for phish are stupid' is actually counterproductive for building an effective security culture," Margot says. "People don't usually think about an organization's security culture when they talk about combating phish, but it is important, and it's another example of how people are a part of the system. That's why it's important to consider the system as a whole, and why I wanted to learn about users and how they use email."

W80-4 Sandia/California has major role in complex nuclear weapon Life Extension Program

REVIEWING RESULTS — The W80-4 mechanical team reviews the results of thermal analysis. From the top center, counterclockwise, are Ryan Johnson, Bryn Miyahara, Alvin Leung, and Matt H. Jones (all 8248). (Photo by Randy Wong)

By Sue Major Holmes

Sandia is doing what it hasn't done in decades: extending the life of a nuclear warhead at the same time the US Air Force develops a replacement cruise missile that will carry the weapon.

The goal of the W80-4 Life Extension Program (LEP) is refurbishing the W80 warhead with replacement components for aging technology and components that have limited lifespans. Sandia's California site is responsible for development of non-nuclear components and subsystems and for systems integration. Lawrence Livermore National Laboratory is responsible for the refurbishment of the nuclear explosive package and joint development of detonators with safety features.

"The LEP will update the interface between the warhead and the missile to meet current Air Force standards and requirements, ensuring nuclear safety and security," says Paul Spence (8248), who joined the program in February as manager of the W80-4 Systems Integration department. The W80-4 LEP builds on programs that began more than a decade ago.

The W80-4 LEP is moving from the concept phase, which includes system architecture development, mechanical layout, and preliminary component design, to the feasibility study phase, which includes more detailed design work, maturing component technologies, and fabricating prototype hardware. The feasibility study phase, officially known as Phase 6.2, was approved July 23 by the Nuclear Weapons Council (NWC).

In August 2014, the NWC, which coordinates stockpile activities for DoD and NNSA, chose the W80-4 as the warhead for the Long Range Stand Off missile, the Air Force's successor to the current Air Launched Cruise Missile.

"Developing both at the same time requires a lot of cooperation and coordination between Sandia and the Air Force," Paul says. The last time a missile and warhead were developed and fielded concurrently was in the late 1980s with the W87 and W88 and the ballistic missiles on which they are carried.

Based on the president's budget request, the W80-4 LEP budget would increase in fiscal year 2016. The systems integration element of the program expects staffing to increase next year and again the following year, which Paul says requires accelerated hiring in multiple fields from engineering to computer modeling and simulation. "We will develop the next generation of weapon scientists and engineers and give them hands-on experience in a system development and integration program," he says.

Teams shared resources necessary to succeed

After nuclear testing ended in 1992, the US began extending the life of existing warheads rather than developing new ones for the stockpile. Because many of those on the W80-4 team have been at Sandia for less than a decade, they will team with more experienced staff on the warhead program. The program also will take advantage of experience gained in other ongoing life extension programs at Sandia.

The W80-4 LEP requires Sandia to coordinate development work with the B61-12 LEP, the W88 ALT (Alteration) 370, and the Mark 21 Fuze Replacement programs. The four programs will share the Labs' resources, everything from microchip fabrication at the Microsystems and Engineering Sciences Applications complex to computational simulations to large-scale testing at Sandia's major environmental test facilities.

Originally, the W80-4 program was to begin producing weapons for the stockpile in 2027, but this year that milestone was moved up to 2025. "The schedule has been compressed and we have less time to do the development work we need to do, so that's also going to be a challenge we will meet," Paul says.

The W80-4 LEP is likely to become the largest weapons system development and integration effort at the California site in two decades. The W80 was originally developed by Los Alamos and Sandia, with the first units fielded in 1982.

"It's exciting to have the program in the Livermore Valley. It's important to build strong partnerships between our New Mexico and California sites and collaborate closely with Lawrence Livermore and production agencies like the National Security Campus in Kansas City," Paul says. "Sandia will also work with Pantex, Savannah River, and others. There will be lots of interactions to build on and grow."

TEAMWORK — Gathered in front of preliminary designs for the W80-4 are members of the team: top left (standing): Lee Druxman (8248), Matt C. Jones (8248), Gabe Lopez (8237), Holly Mendonca (8244), Ryan Johnson (8248), Angela Clark (8531), Jennifer Wohleber (8534), Young Anh (8237), and Helen Smith (8248); bottom left (sitting): Bryn Miyahara, Alvin Leung, and Joyce Liang (all 8248). (Photo by Randy Wong)

Cyber Technologies Academy reaches out to teachers

Boot camp focuses on hands-on cyber lessons, training exercises

By Michael Padilla

Two hands-on Cyber Technologies Academy (CTA) teacher boot camps were recently held at Sandia/California to help improve and promote cyber security education.

Levi Loyd (8965) says the boot camps are an excellent way to reach out to science, technology, engineering, and mathematics (STEM) teachers who want to broaden their cybersecurity curriculum. The boot camps provided teachers with cyber lessons and training exercises they can take back to classrooms, thus helping prepare students for careers in cybersecurity.

"We have been involved in cybersecurity education primarily focusing on students for quite a while," says Levi. "We wanted to expand our focus and reach out to teachers to help engage students and get them interested in cybersecurity at an early age."

CYBER TECHNOLOGIES ACADEMY Boot Camp developers include, bottom row, left to right: Anuj Kak, Samantha MacIlwaine, Makena Harmon, Evan Laufer (all 8965), and, top row, CW Perr and Steve Hurd (both 8966). (Photo by Dino Vournas)

Funded through Sandia's corporate outreach program, the boot camps had more than 40 participants this summer. Teachers participating in the program came from across the state, including Fremont, Oakland, Sacramento, and southern California.

Force multiplier effect

Jeremy Erickson (8965) says by reaching out to teachers, the CTA multiplies its outreach efforts. Because of space, time, and budget constraints, Sandia can only reach out to approximately 250 students per year, but by reaching out to teachers, they in turn can potentially reach more students, he says.

"If 10 teachers each teach 50 or 100 students in their computer classes, we suddenly have expanded that reach to 500 or 1,000 students instead of just the normal number of students we reach out to each year," he says.

Part of the goal in establishing the teacher boot camp, Jeremy says, was to deliver enough material to the teachers so they can then replicate the material to students.

"We are not educators," he says. "We are scientists, researchers, and engineers. The idea was to partner up with professional educators who know how to teach and how to educate. We can provide the technical component that they may not be capable of doing."

As part of the boot camp, Sandia provides teachers with a customizable learning platform in the form of a bootable Linux USB disk. This helps allow schools to boot directly from this Linux disk, leaving school systems able to stand alone.

Developing, strengthening collaborations

Last summer Sandia hosted several teachers from South Carolina and continues to strengthen its relationship with Project Lead The Way, a provider of K-12 STEM programs.

Carol Kinnard, associate director of instruction with Project Lead The Way in Indianapolis, Indiana, says the boot camp helped her better understand the ethical issues around cybersecurity, the Linux operating system as it applies to file structures and networking. She also said the boot camp helped her better understand how Internet protocols work and how some networking tools enabled her to protect some systems while exposing others to network penetrations.

She says Project Lead The Way will be developing a cybersecurity course that will be part of its high school computer science path.

"We are very interested in collaborating with Sandia, acknowledging that they are an industry leader in securing computer systems at all levels," she says. "As we bring our national computer science curriculum to schools around the country, we are committed to staying relevant and timely, and we recognize cybersecurity is a pressing issue we all need to address."

Chris Lorenz, instructor with Allied Health Academy at Valley View High School in Moreno Valley, California, says although the bootcamp was very challenging mentally, the Sandia instructors kept the teachers on track and answered all the questions to ensure they were successful.

"I would highly recommend this class to anyone who is interested in cybersecurity," he says. "To actually work with industry professionals, such as those from the Sandia Labs, was so helpful and encouraging. The instructors were very knowledgeable and very helpful to all students. I also was impressed by how they addressed each student's needs from the most experienced to the beginner."

Lorenz says having access to Sandia's materials and classroom program is a huge plus. He says he now has the tools to return to the classroom and begin teaching.

"I also feel I have a huge support system from the Sandia instructors and other staff if I run into any problems," he says.

Future teacher boot camps are being planned and as Sandia continues to partner with more schools, offerings will be refined to address school-specific constraints or concerns.

Recycling algae

(Continued from page 1)

costly artificial nitrogen fixation process using natural gas and atmospheric nitrogen, phosphate is a limited natural resource that can be toxic at high concentration.

"We have a finite amount of phosphate in the world, but it's in high demand as a fertilizer. Half of the phosphates that go into our crops in the form of fertilizer end up in the Gulf of Mexico, contributing to hypoxic zones," says Todd. Better known as "dead zones," hypoxic zones are areas of low oxygen concentration that kill or drive out marine life.

Economic models show that replacing just 10 percent of liquid transportation fuels with algal-derived fuels, though beneficial to the environment in many ways, could double fertilizer consumption, which, in turn, would drive up the cost of food.

But recycling phosphates means everyone wins: algal-derived biofuels producers, farmers, and the environment. "By recycling phosphates from one batch of algae to the next, we save money, no longer compete with agriculture for a non-renewable resource, and keep those phosphates out of the environment," says Todd.

Todd and Ryan are considering other applications for their closed-loop algae nutrient recycling methods.

"Our method could be used to strip phosphates from the agricultural runoff before it reaches the Salton Sea," says Ryan. Fertilizer runoff into the saltwater sea, California's largest lake, has led to dead zones that threaten fish and other wildlife. "Those nutrients that would otherwise further contribute to the dead zone could be used to grow algae intentionally for biofuels and other biobased commodities."

Osmotic shock key to releasing phosphates

Todd and Ryan found their nutrient recycling method works on many different algae feedstocks, even mixed feedstocks. Because algae have more genetic diversity than any other organism, many methods developed in the past haven't worked universally.

The researchers use a fairly simple process, osmotic shock, to liberate phosphate from the cultivated algae. "We shock the algae with fresh water while controlling certain conditions like pH and temperature. This disrupts the internal structure of the cell and releases naturally occurring enzymes," says Todd. "These enzymes chew up the cell and rapidly release the phosphates."

The next step is fermentation to convert the nitrogen, which is mostly in the form of amino acids, into ammonia. The phosphates and ammonia are then recombined — with help from magnesium, present in great quantities in the algal biomass — to form struvite, a solid salt.

In 2014, a Sandia team proved the method with 20 weeks of continuous recycling and reuse of phosphates and nutrients. They were able to carry more than 60 to 80 percent of the nutrients from batch to batch.

"Every two weeks, we recycled the nutrients and fed them back into the next batch of algae," says Ryan. "The process worked better than we expected, as we saw enhanced growth with the recycled nutrients. We aren't quite sure why this happened. It could be from trace metals carried over in the phosphate."

Lipid extraction enables nutrient recycling

The algae nutrient recycling research is part of a larger project funded by DOE's BioEnergy Technologies Office, part of the Energy Efficiency and Renewable Energy program. The Sandia team's partners include Texas A&M AgriLife Research, which grows marine strains of algae, and Texas-based OpenAlgae, which patented methods to lyse algal cells and recover algal lipids without using solvent. Recovered algal oils could be turned into fuel.

"We were very interested in OpenAlgae's lipid extraction because it doesn't use solvents, so the biomass is left in a native conformation that works very well with our process," says Todd.

OpenAlgae's method subjects algae cells to high-energy electromagnetic pulses that rupture the cell walls and cause the cells to burst, releasing the lipids. In this disrupted state, the algae cells are much more susceptible to osmotic shock.

The nutrient recycling process also releases more compounds that can be turned into fuels. "There is a lot of protein in biomass and that soaks up the nitrogen. As we're liberating the ammonia, we're also capturing that carbon so it can be turned into fuel," says Ryan.

Better and easier nutrient recycling

Todd and Ryan are working to further refine their method to recycle more of the nutrients, including a collaboration with James Liao of the University of California, Los Angeles, to genetically refine their fermentation strain to increase yield and extract different fuel products. Liao runs the Metabolic Engineering and Synthetic Biology Laboratory and is chairman of the department of chemical and biomolecular engineering and the department of bioengineering.

Another facet of the project is the development of a reactor system to capture the ammonia as the biomass is fermented to release phosphates. Currently, these steps are performed separately.

"The goal is a one-pot system," says Ryan. "That will be the tipping point for scaling up our method. We grew 2 liters of algae in our 20-week test. The next step is to grow 3,000 liters in our raceways." Later this year, Sandia will open three 1,000-liter raceway testbeds, shallow artificial ponds for algae cultivation.

Pond-side processing is another goal. A single module combining lipid extraction and nutrient recycling could separate biomass into nutrients and fuel at a cultivation facility.

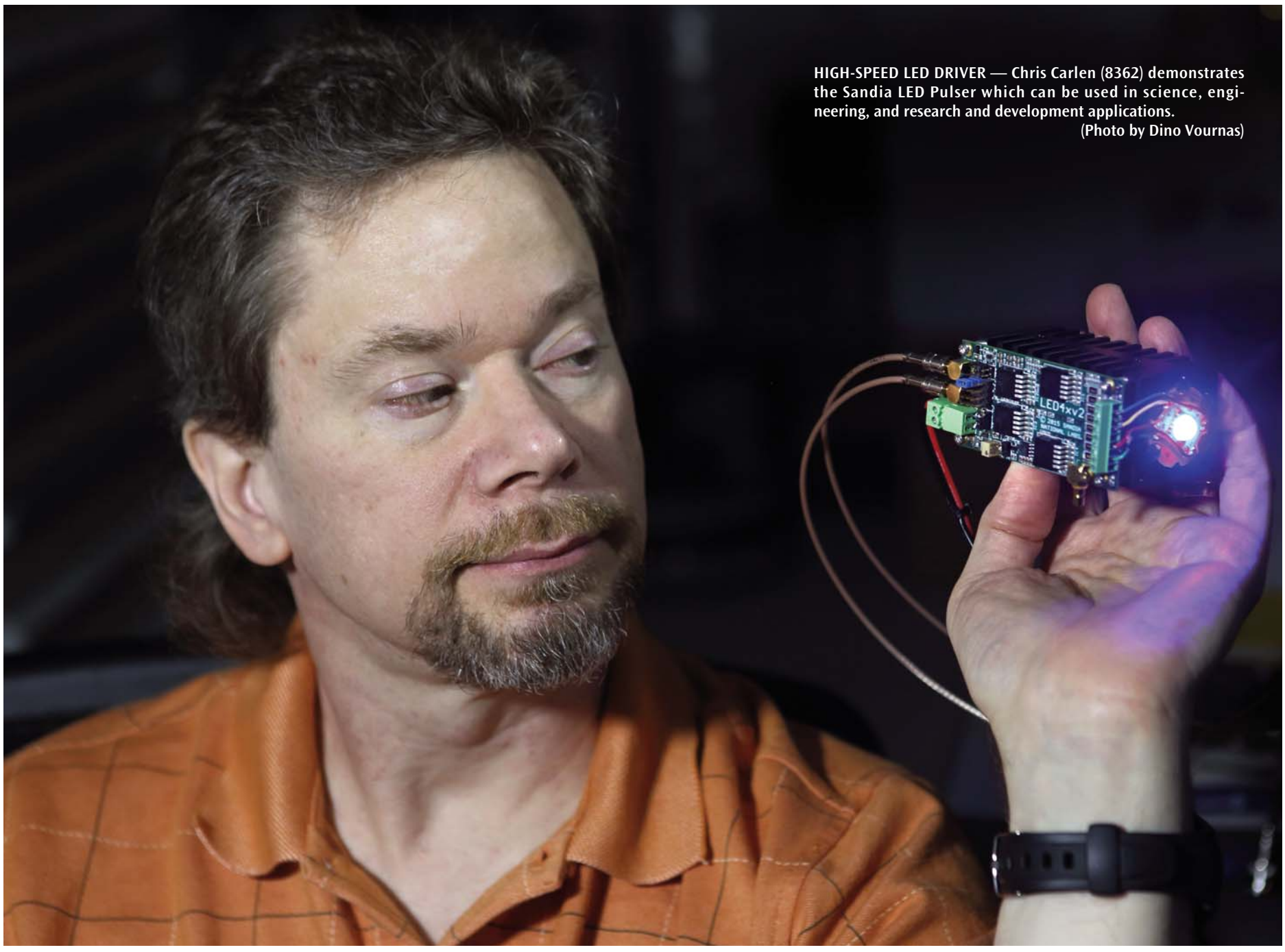
Panning for phosphate gold

Todd and Ryan think their method could help the environment if applied to agricultural runoff.

Nutrient recycling is like panning for gold — or in this case, phosphates — anywhere that fertilizer-laden agricultural runoff enters bodies of water. The key, says Todd, is getting the concentrated runoff before it enters the body of water and dilutes.

"Our method can't fix the existing dead zones," says Todd. "But it can stop them from growing. The irony is that those nutrients are so valuable to growing plants, but so damaging when they flow into large bodies of water. Isaac Asimov famously called phosphates 'life's bottleneck.' We aim to put an end to that bottleneck."

LED Pulser: Laser-like performance, fraction of the cost



HIGH-SPEED LED DRIVER — Chris Carlen (8362) demonstrates the Sandia LED Pulser which can be used in science, engineering, and research and development applications.
(Photo by Dino Vournas)

By Michael Padilla • Photo by Dino Vournas

When Chris Carlen (8362) developed an enthusiasm for flashlights containing high-power LEDs, he didn't anticipate that his hobby interest would lead to the creation of a new, high-speed LED driver delivering lighting performance that exceeds that of conventional sources at a fraction of cost.

The Sandia LED Pulser provides high-brightness, rapidly pulsed, multi-color light for scientific, industrial, or commercial uses. In some cases, the LED Pulser can even displace lasers.

"I had the idea a few years ago to see if high-powered multi-colored LEDs in flashlights could be turned on and off rapidly by an electronic circuit to produce short light pulses similar to that of a 10-nanosecond pulsed laser, or even down to one nanosecond depending on the LED," Chris says. "It was more of a curiosity initially, but then something came up where a light source being used in a lab wasn't working out, so I decided to try to make a quick prototype to pulse an LED, which worked out pretty good."

Contributing to new scientific discoveries

The LED Pulser can be used in various science, engineering, and research and development applications that are otherwise possible only with far more expensive laser or arc-lamp light-sources and optics.

It has already been used in several research studies that have helped Sandia take the lead in developing the science base needed by engineers to design and optimize cleaner, more efficient engines, thereby impacting local air quality and public health as well as global climate change.

In one of these studies, a high-speed backlit spray microscopy application, the LED Pulser delivered 50-ns pulses at 200 kHz that "froze" the motion of liquid droplets and ligaments. This enabled high-resolution imaging of atomization in a high-pressure diesel fuel-spray. Spray atomization and mixing profoundly affects the combustion process in both spark-ignition and diesel engines, impacting both efficiency and emissions.

The LED Pulser was also used in a high-speed soot extinction imaging application. In this work, the LED Pulser generated high-intensity pulses matched to the camera exposure duration (2 microseconds) to enable quantitative evaluation of the evolution of diesel soot concentrations. The strong pulse intensity relative to combustion-generated light allowed full-field soot imaging at high frame rates, providing information needed to predict soot formation and oxidation processes.

A final example is the application of the Pulser for ignition detection via high-speed Schlieren imaging. The small LED source allows for excellent light beam collimation, while the wide bandwidth relative to lasers enables speckle-free imaging. Work in this area has led to the unambiguous identification of first- and second-stage diesel ignition locations, leading to a better understanding of how pilot fuel injection strategies impact combustion and emissions formation.

A driving force

Using custom electronic circuitry, the LED Pulser drives high-power LEDs to generate light pulses with shorter duration, higher repetition frequency, and higher intensity than do commercial off-the-shelf LED drivers. The device's ability to combine high intensity and short pulse duration is critical, as simply decreasing the pulse duration while maintaining the same intensity as a continuously powered LED would reduce the light energy delivered per pulse.

Increasing intensity with short pulses maintains the level of light energy delivered, which is essential for many applications. The LED Pulser can be an extremely economical replacement for lasers in some applications. Further, a single device can emit up to four different colors, each with independent pulse timing, from a nearly coincident source area. This capability should expand the range of optical applications, as well as enable new imaging techniques.

Moreover, the low cost of this device will allow much broader use of diagnostic techniques throughout the scientific and engineering communities, leading to faster progress in developing an understanding and ability to predict important physical processes.

Overcoming technical challenges

Chris is focusing on several technical challenges to improve the LED Pulser.

"There are still some things that can be done to try to make it better," he says. "When dealing with extremely high currents in very short times, rather exotic techniques need to be used."

Since the LED Pulser is designed to deliver as much power as possible, the circuits currently drive the LEDs to the brink of destruction. Failure rates with this design, while acceptable in a research environment, are not appropriate for the commercial market. Commercializing the device for applications outside of scientific research would require either reducing the delivered power to a level that yields an acceptable failure rate or improving the design to achieve a low failure rate even at the high delivered powers.

Chris is working on an LED Pulser that is 10 cubic inches in size and can produce 240 amps of drive current, for about 150W of peak optical power, depending on the LED used.

"What's interesting about the Pulser is the power density, i.e., how much power it can deliver compared to its size," he says.

There are several areas he is focusing on to improve the LED Pulser. One area is to build a faster driver circuit and improve the connection between the driving board and the LEDs — driving toward pulse durations of less than 10 nanoseconds. Another area of consideration, key to potential commercialization, is to devise a protection circuit to greatly reduce the chances of destroying the LEDs.

"I didn't anticipate the LED Pulser would become as popular as it has," he says. " I'm just happy if it is helping to solve people's problems."

Sandia/California increases water conservation efforts as protracted state drought continues

CONSERVATION MOTIVATION — Robert Holland (8516) says Sandia/California is aggressively exploring water reduction strategies by looking for innovative ways to irrigate the landscape and by installing new water metering systems. (Photo by Dino Vournas)

By Michael Padilla

As California continues to battle extreme drought, Sandia/California has increased its efforts to aggressively explore water reduction strategies.

"It's been a challenge," says Robert Holland (8516). "But it's doable."

Robert, who is helping to spearhead efforts to increase water conservation projects throughout the site, says the California site has been meeting the challenge with landscape reduction, innovative ways to irrigate, and installation of new metering systems.

Laura Tidwell (8516) says the Environmental Management and Physical Operations Planning & Study departments (8516 and 8512) have been evaluating all options in ensuring that Sandia is looking for ways to conserve water while meeting the needs of the site.

Meeting state, federal mandated regulations

When California Gov. Jerry Brown issued an executive order in 2015 to increase water conservation requirements in California, Sandia was already in front of the issue. The challenge, however, was to reduce water usage by 25 percent from 2013 set by the order.

Since the order went into effect, Sandia has stopped irrigating most of the seven acres of turf at the site and reduced the irrigation of other areas to twice a week. For calendar year 2014, these efforts have helped the site reduce water use by more than 16 percent from 2013. The site is on track to meet the 25 percent reduction in 2015.

Laura says part of the challenge in meeting the state's water conservation target is the site's use of water in many other ways, including cooling towers that provide chilled water for buildings and lab equipment. Plans to reduce usage in areas such as cooling and processing water will require significant infrastructure modifications that have not yet been prioritized by the federal government.

For many DOE laboratories water reduction has been an active conservation activity for eight years. Sandia is on track to meet a federal regulation to reduce water usage by two percent per year from 2007 levels.

"We have been trailing down since 2007," says Robert. "We get our water from San Francisco Public Utility and they have not imposed any water restrictions on the Labs. If they fall under the gun then we will have to follow their guidelines as well."

Creative solutions

One of the latest measures to help conserve water at Sandia/California is installing smart water meters throughout the site. The meters can be read electronically and are more precise than what had been installed.

"One of the challenges we had was not having a strong metering system," Laura says. "You have to have a reliable and accurate way to meter and monitor your usage in order to determine where you may have a problem and how to focus limited funding to reduce usage."

While this may seem not particularly aggressive in a really bad drought, she says, "it's actually a pretty important part of this puzzle and we may be out of this drought before we have it all done. It will be a really good improvement for current and future water monitoring and usage reduction activities."

Another effort has been to slightly increase the temperature in buildings following recently updated corporate guidelines. The key point is that each building will continue to run efficiently and these minor adjustments will not impact day-to-day operations.

"Sandia will gain some water savings with comfort cooling," Laura says. "By raising the temperature in some buildings by one degree, we can save water."

Robert says the site has an ongoing project to remodel bathrooms, updating water fixtures as needed. High-occupancy buildings have been updated and others will be updated as time and budget permit.

In addition, the site may further limit irrigation in terms of acreage, frequency, and duration. Irrigation systems will be shut off when the forecast calls for rain. Sandia will continue to keep up with the site's aesthetics and will ensure that high-traffic areas are well maintained.

"We will also follow the priorities set by our master landscape plan for planting drought-resistant groundcover, plants, and trees and for managing storm water," says Robert.

Education is crucial

Laura adds that education is key to ensure that the members of the workforce understand how to help conserve water. An education campaign is underway to help people think of and implement creative ways to help conserve water.

"Simple tasks such as not running water when washing dishes at lunch or reporting unnecessary on-site water use is helpful," Robert says. "Informing Facilities about broken pipes or broken sprinkler systems is also welcomed."

In addition, a Water Reduction Working Group has been established to further explore water conservation projects, identify areas of water waste, and provide input to site management on water reduction opportunities.

Both Laura and Robert welcome any feedback, and encourage members of the workforce to call the Facilities Urgent Request Hotline at 925-294-6400 with ideas or concerns.

Arroyo Seco ready to rise to occasion

By Madeline Burchard

Some trees and plants at Sandia/California are still being watered, which seems to contradict the widespread calls for water conservation. To understand why, look back to the winter of 1997-1998 when California experienced unprecedented rain and flooding — the warmest and wettest in the 104-year record of temperatures and precipitation measurements.

Impact to Arroyo Seco

The January/February storms in 1998 were felt strongly in Livermore and at the California site. In those two months, nearly 13 inches of rain fell (compared to the 30-year mean of 5.41 inches in January and February). The runoff overwhelmed the Arroyo Seco watercourse, which runs through the site, and flooded many areas including the East Avenue entrance. Significant erosion undermined the structural integrity of bridges and utilities crossing the Arroyo Seco. Several trees came loose from the banks and threatened to compromise sewage pipes.

Since then, Sandia has been working in partnership with the Army Corps of Engineers to repair that damage via the Arroyo Seco Improvement Program (ASIP).

ASIP starts ASAP

"ASIP is intended to provide active channel improvements and stream zone management activities that will reduce current flood and erosion risk while providing additional and improved habitat for sensitive species," says Robert Holland (8516), environmental technical professional with Environmental Management.

ASIP includes 18 projects along Arroyo Seco to boost the site's resilience to major storm events. These projects included installing concrete reinforcement to support critical points of the stream; removing impediments to stream flow such as land bridges; and planting denuded banks with native grasses, shrubs, and trees. These plants, when established, will soak up water and keep the stream banks intact.

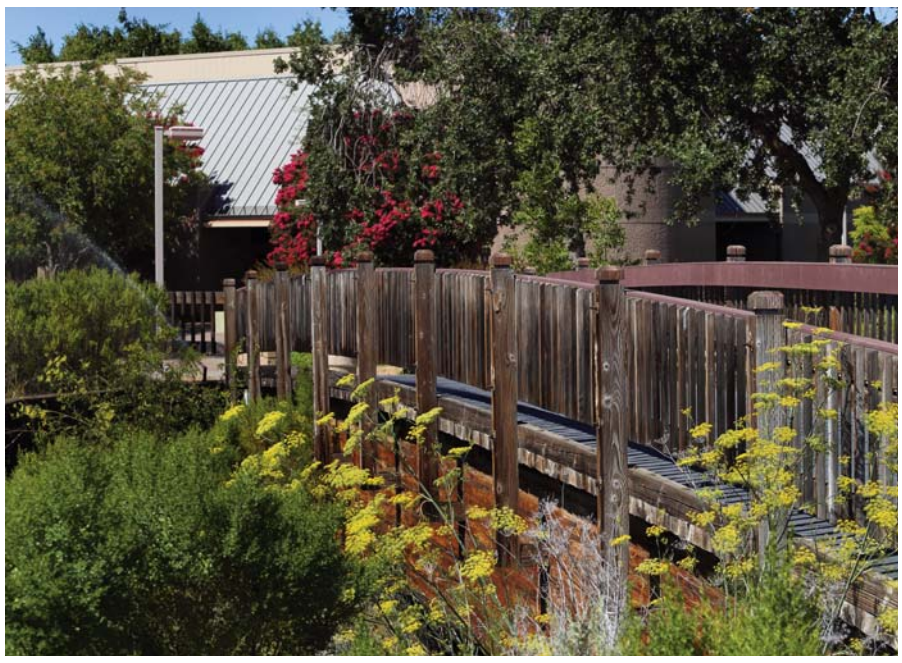
Watering during a drought

The most recent ASIP development is the creation of a flood plain with trees and native shrubs near Thunderbird Lane at the upstream end of Arroyo Seco. This flood plain will help slow runoff flow and provide habitat for sensitive species.

All active restoration will be completed by Sept. 30, but the site must ensure that a majority of the new plants will survive year to year. In a severe drought year, this means irrigation.

Irrigation done in accordance with Sandia's Corps of Engineers permit is not counted by federal agencies against water reduction targets. Even with tree irrigation factored into water usage estimates, Sandia is on track to meet the 25 percent water use reduction requested by the state.

"Survival of our trees and plants is mandated by our federal permit," Robert says. "Our restoration efforts will be followed by a three-year period of irrigation as ordered by the Corps of Engineers and the Regional Water Quality Board."



BOOSTING RESILIENCE — Sandia is working with the US Army Corps of Engineers to repair on-site damage to Arroyo Seco caused by heavy rains in 1998. The runoff from a series of storms overwhelmed the Arroyo Seco watercourse; the resulting erosion undermined the structural integrity of bridges and utilities crossing the arroyo. (Photo by Dino Vournas)

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STUDENT TRUMPET, w/case, excellent condition, $125; saxophone, alto, w/case, excellent condition, $275. Aragon, 888-3473.

WEDDING BAND, women's, 14k white gold w/diamonds, matching earring set, carat weight .70, valued at $1,750, asking $1,250. Ramos, 505-220-5201.

HORSE TRAILER, '07 Exiss ES20, cherry condition, new tires, only used 2 seasons, see Craiglist photos, $8,500. Smith, 505-221-6821.

BED SET, king, beautiful, oak headboard w/bookcase, frame, box spring, mattresses, 2 night stands, you haul, $375. Freshour, 505-301-2076.

'BOOK OF MORMON' TICKETS, 2, 9/19, orchestra, row P, $80 ea. or $150/pair. Eager, 299-6874.

PATIO DOORS, wrought iron, w/mounting frame, 78" x 36", door handle box, 2 ea., black, $165. Schroeder, 505-917-4516.

POOL TABLE, Olhausen Americana, like new, paid $2,500, asking, $1,250, can help move. Jones, 514-3589.

TABLE, rectangle, beautiful,40" x 22", light/medium golden brown, excellent condition, photos available, $125. de la Fe, 903-0717.

WATER SOFTENER, Kenmore, model 34845, never installed, Dr. said no salt. Stevens, 293-5704.

STATIONARY EXERCYCLE, programmable, ProForm, batteries included, like new, bring a truck, $150 OBO. Edwards, 323-2924.

PORTABLE ICE MAKER, Magic Chef MC1M30SST, 24-hr. ice making, capacity up to 30-lbs., 12-pcs. per cycle (7-18 mins.), $150. Gehrke, 263-7327.

BIKE TRAILER, Burley Bee, 2-position, new, assembled but never used, $225. Delaplain, 275-1858.

MEDIA CABINET, oak, on wheels, glass doors, 48"H x 19"W x 17-1/2"D, $150; men's water skis, used once, like new, $50. Drebing, 293-3335.

'BOOK OF MORMON' TICKETS, 2, center, orchestra section, Popejoy, 9/18, $85 ea., cash only. Kelly, 299-3527.

STEP LADDER, fiberglass, 12-ft., East Mountains, $100. Willmas, 281-9124, ask for Jack.

KEYBOARD AMP/COVER, Roland KC-500, $325; Roland CUBE street amp, $150; M-Audio 8x8 monitors/Auralex pads, $300. O'Toole, 382-6051.

LABRADOR PUPPIES, Bernalillo county, 8 wks., yellow & black, parents on-site, good temperament, unpapered, $250. Heald, 505-485-7474.

SONY 3D TV GLASSES, 2 pair, new, $25. Hennessey, 505-269-6423.

SUITCASE, large, black, $30; suitcase, medium, tan, $20; Pittsburgh Steeler leather jacket, men's, large, $100; women's leather jacket, medium, $40; women's faux leather jacket, medium, $20. Thorpe, 331-1153.

DRESSER CHANGING TABLE, 3 large drawers, single drawer, door w/ shelf, natural color, good condition, $175. Nordquist, 505-400-1535.

TRANSPORTATION

'01 DODGE NEON, 4-cyl., 4-dr., cold AC, 157K miles, runs great, $2,000 OBO. Padilla, 239-9017.

'04 DODGE STRATUS R/T COUPE, 1 owner, black, faded paint, no mechanical problems, 120K miles, good tires, $1,600 OBO. Kubal, 505-228-2669.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday. Submit by one of these methods:

- **EMAIL: Michelle Fleming (classads@sandia.gov)**
- **FAX: 844-0645**
- **MAIL: MS 1468 (Dept. 3651)**
- **INTERNAL WEB: On internal web homepage, click on News Center, then on *Lab News* link, and then on the very top of *Lab News* homepage "Submit a Classified Ad."**

If you have questions, call Michelle at 844-4902.

Because of space constraints, ads will be printed on a first-come basis.

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

'04 CHEVROLET BLAZER, 2WD, 4-dr., AT, AC, 68K miles, excellent cond., $4,000. Graham, 505-379-8798.

'08 SATURN VUE XE, 3.5L, V6, AWD, black, OnStar/XM ready, '14 tires, 95+K miles, $7,200 OBO. Griego, 505-553-9399.

'06 MAZDA MX-5 CONVERTIBLE, soft top, 38K miles, excellent cond., $11,500 OBO. Pratt, 256-7408.

'06 FORD F150 FX4, supercab, flareside, 5.4 L, V8, AT, leather seats, running boards, gray, shell, $15,500. Romero, 505-307-9389.

'00 FORD RANGER, 5-spd., air, heat, CD, multiple add-ons, new engine, 200K miles, great condition, $3,800 OBO. Crosby, 260-1070.

'01 BUICK PARK AVENUE, AT, AC, leather, 103K miles, good condition, $3,000. Graham, 505-379-8798

RECREATION

'99 MAXUM 1900/SR BOAT, 19-ft., 5.7 mercury engine, 250-hp, bimini top, bow & cockpit cover, depth finder, fish finder, radio/ stereo, $7K. Joseph, 505-515-5997.

'13 ARCTIC FOX 811 TRUCK CAMPER, generator, solar panels, must see, $24,495. Ryan, 505-934-0684.

'13 VICTORY VISION TOUR, 7K miles, extended warranty, loaded, all options, perfect condition, $15,500 OBO. Goodson, 505-407-1688.

MOUNTAIN BIKE, ladies, 26-in., gel seat, bottle rack, owner's manual, cream puff, $100. Murphy, 892-0288.

ELLIPTICAL BICYCLE, Elliptigo 8C, green, like new, used 3 times, paid $2,400, asking $1,700. Schriner, 505-275-3312.

'08 HONDA GOLDWING, GPS, ABS, comfort pkg., 17K miles, excellent cond., $14K. Kirkpatrick, 238-2288.

SAILBOAT, Hobie Getaway, 16-ft., catamaran w/trailer, durable polyethylene construction, holds 1-6 people, ready for sailing, $2,500. Dwyer, 505-271-1328.

'93 FEATHERLITE, 4-horse gooseneck, w/mangers, living quarters, AC, bathroom w/shower, mats, 3-ft. wall mats, rear tack, $17,500. Davis, 286-4757.

REAL ESTATE

20 ACRES, beautifully wooded, East Mountain area, near I 40, real estate contract considered, $7,500/acre. Heisey, 379-1147.

WANTED

HOST FAMILY, international student, attending Menaul School, from Democratic Republic of Congo, email for info. Bolt, 505-341-7223, aboldt@menaulschool.com.

DRIVER/NANNY, drive 10 & 13-yr.-old girls to after-school events, NE Heights. Saltzstein, 237-2668.

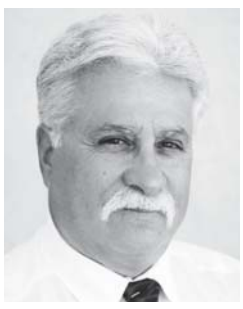
OLD CABINETS, & countertop, will haul away, photos requested, but call first. Carroll, 505-206-8837.

ROOMMATE, in spacious home, walk-in closet, big house, Westside. Kovala, 785-213-6513.

VOLUNTEERS, Fabulous Felines, work with rescued cats, www.FabulousFelines.org. Stubblefield, 263-3468, fabulousfelines@comcast.net

Mileposts

New Mexico photos by Michelle Fleming



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Bill Morgan
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Ted Simmons
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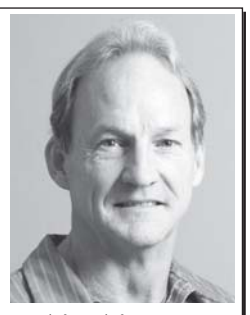
Recent Retiree



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Terry Calloway
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Harold Hjalmarson
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Pam Mincey
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Gary Sanders
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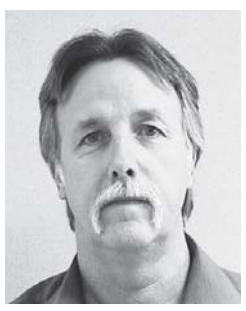

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Tom Souther
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Frank Vigil
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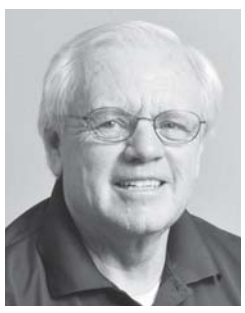

Pete Argo
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Georgianne Huff
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Imelda Quam
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Neal Shinn
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Cynthia Acosta
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Anna Baca
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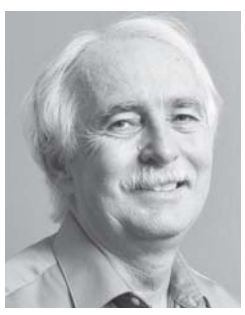
Eric Burns
25 1741



Frank Loudermilk
25 1756

Tony Ohlhausen
25 1819

Chip Roma
25 4135

Jerry Simmons
25 1000

Reuben Martinez
20 5419

Sarah Renfro
20 810

Edward Piekos
15 1513

John Norden: in case of emergency

EMERGENCY EXPERTISE — John Norden (8511) brings a wealth of experience to his new role as Emergency Management coordinator at Sandia/California. John says one of his goals is to involve more members of the workforce in emergency drills and increase the Community Emergency Response Team numbers. (Photo by Dino Vournas)

By Patti Koning

John Norden (8511) may be new to Sandia, but not to national security. Protecting borders in El Paso, Texas, and West Berlin; working with a drug-sniffing dog at the Port of New Haven; keeping the skies safe as a Federal Air Marshal; and serving on the police force of his hometown in Connecticut — it's all part of the rich and diverse background that John brings to his role as the emergency management coordinator at Sandia/California.

"My life on a piece of paper, that's what I thought when I saw the job description," says John.

Dennis Baker (8511), manager of the site's security operations and John's boss, was hoping to find a candidate with either first responder or military experience, preferably with a tactical background, and emergency management training. In John, he found all four.

"It's rare to find someone who has been a first responder and is trained in emergency response," says Dennis. "John is the complete package."

John's circuitous path to Sandia began when he enlisted in the US Army just after graduating from high school. He served four years as a tank gunner, including two years protecting the then-West Berlin border in Germany.

After returning to the US, he served in the Army Reserve and attended college on the GI Bill. While completing his undergraduate degree in criminal justice at George Mason University, he worked as an intern for the US Customs and Border Protection (CBP). That turned into a CBP position as an inspector in El Paso.

The El Paso Sector, one of nine that runs along the southwestern border of the United States with Mexico, encompasses 125,500 square miles and 268 miles of international border in New Mexico and part of Texas. The Rio Grande separates El Paso from Juarez, Mexico, making the region the second largest binational metropolitan area, after San Diego-Tijuana, on the southern US border.

John was quickly introduced to the illegal drug trade and human smuggling at the busy border. On his first day on the job, he and the field-training officer he was shadowing found 19 tons of marijuana in the back of a truck.

"Mostly it was narcotics interdiction," he says. "I quickly became familiar with the cars and trucks used for drug smuggling and learned to spot hidden compartments in the vehicles."

Then 9/11 happened

After two years, John transferred to Connecticut's Port of New Haven, where he monitored port activity with the help of a drug-sniffing dog. "This was a terrific job," says John. "New Haven is a small port, so it was a one-man operation, just me and a dog. I interacted a lot with other agencies, which served me well as a police officer."

After eight years in New Haven and the retirement of his service dog, John began considering his next career move. Then 9/11 happened.

His first instinct was to return to the military. "I think practically every former service member wanted to reenlist at that time," John says. "But I had a family with two young children to consider."

He answered a different call and became a federal air marshal. Pre-9/11, there were only a few dozen active federal air marshals. Within a year of 9/11, that number jumped to the thousands. The Federal Air Marshal Service recruited people like John, targeting agencies like CPB, the Drug Enforcement Agency, FBI, and others.

As a federal air marshal, John's primary responsibility was to counter terrorist attacks on airplanes. "An air marshal's job is to blend in with the passengers and serve as the eyes and ears of security," he says.

He logged thousands of hours on airplanes, traveling on everything from northeast corridor commuter routes to cross-country and cross-Atlantic flights. After five years of days lasting as long as 18 hours and shrinking time off, it was time for another career change.

"My job as an air marshal became increasingly tough on my family," says John. "It came down to the job versus my family."

John took on a new role that required him to stay very close to home — he joined the police department of his hometown North Haven, Connecticut. A town of about 25,000 people, North Haven is a suburb of New Haven, the second largest city in the state.

North Haven's police force was small, only about 45 officers during John's time, which meant each officer filled multiple roles. John also served on the department's SWAT team and was a first responder to emergencies in North Haven and surrounding communities.

"I was involved in many different investigations — domestic violence, sexual assault, narcotics, robberies — and carried them all the way through to the end," he says. "On a larger police force the work would be much more segmented."

Once his children were in high school, John began considering other ways to use his diverse skills. "I really enjoyed being a community police officer, but it's a low-paid, stressful, and difficult job," he says. "You spend much of your time focused on the dark side of humanity."

He completed a master's degree in emergency management at the University of New Haven to build on his experience, which turned out to be the very thing Sandia was looking for. And he was looking for exactly what Sandia had to offer — a chance to apply his new skills and extensive experience to a different national security role.

He thinks his experience as a first responder will enable him to be an effective leader if an operational emergency occurs. "I've been in those situations, so it's like second nature," he says.

John is not the only new face in the California site's emergency operations. Robert Pedersen (8511), who previously served in the San Francisco Police Department, joined the Security Operations group not long after John. Dennis is looking to add a third emergency operations planner soon.

The site's Emergency Operations Center (EOC) recently was redesigned to facilitate communication among the many different roles that contribute to emergency management. John is holding tabletop drills biweekly with a focus on different emergency management area each month.

One of John's goals is to involve more members of the workforce in drills and increase the Community Emergency Response Team (CERT) numbers. In an emergency, CERTs play a critical role in serving as the eyes and ears in the field and leading basic emergency response efforts.

"If an emergency occurs, I want to empower the emergency response team to act quickly and decisively," he says.